Second Five-Year Review Report

Ordnance Works Disposal Areas Site

Morgantown, Monongalia County, West Virginia

Prepared By:

U.S. Environmental Protection Agency

Region 3, Philadelphia, Pennsylvania

Ronald J. Borsellino, Director
Hazardous Site Cleanup Division

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Date

ORDNANCE WORKS DISPOSAL AREAS SITE
FIVE-YEAR REVIEW REPORT No. 2

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LIST OF ATTACHMENTS

LIST OF ACRONYMS

µg/L	micrograms per Liter
ABS	ABS Environmental Services, Inc.
ARARs	Applicable or Relevant and Appropriate Requirements
bgs	below ground surface
BOD	Biochemical oxygen demand
BTAG	USEPA Biological Technical Assistance Group
BTU	British Thermal Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COPC	Contaminant of Potential Concern
cPAH	Carcinogenic Polynuclear Aromatic Hydrocarbon
CY	cubic yards
DoD	Department of Defense
DuPont	E. I. DuPont de Nemours and Company
EA	Endangerment Assessment
Ecotune	Ecotune Environmental Consultants
ERI	Ecological Restoration, Inc.
ESC	Environmental Strategies Corporation
FAQs	Frequently Asked Questions
FIT	Field Investigation Team
FR	Federal Register
FS	Feasibility Study
FYR	Five-Year Review
GE	General Electric
GTPP	Grant Town Power Plant, American Bituminous Power Partners, LP
HI	Hazard Index
ILCR	Increased Lifetime Cancer Risk
IRIS	USEPA's Integrated Risk Information System Database
Law	Law Engineering and Environmental Services, Inc.
MDC	Maximum Detected Concentrations
MDL	method detection limit
mg/kg	milligrams per kilogram
MIP	Morgantown Industrial Park
MIPA	Morgantown Industrial Park Associates, Limited Partnership
MOW	Morgantown Ordnance Works
MSL	mean sea level
NCP	National Contingency Plan
NHANESIII	National Health and Nutrition Evaluation Survey
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OU-1	Operable Unit 1
OU-2	Operable Unit 2
OWDA	Ordnance Works Disposal Area

LIST OF ACRONYMS (continued)

OWR	WVDEP Office of Water Resources
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PM	Project Manager
ppm	Parts per million (mg/1)
PQL	Practical Quantitation Limit
PRP	Potentially Responsible Party
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RSL	Regional Screening Level
RCRA	Resource Conservation and Recovery Act
RfD	Reference Dose
RFW	Roy F. Weston, Inc.
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act of 1986
SES	Sevenson Environmental Services
SF	Slope Factor
SVOCs	semivolatilte organic compounds
TAL	Target Analyte List
TBCs	To Be Considereds
TCLP	Toxicity Characteristic Leaching Procedure
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
WVDEP	West Virginia Department of Environmental Protection

EXECUTIVE SUMMARY

USEPA Region III, conducted this Second Five-Year Review (FYR) of the remedial actions implemented at Operable Unit 1 (OU-1) of the Ordnance Works Disposal Areas (ODWA) Superfund Site (also known as Morgantown Ordnance Works), located in Morgantown, Monongalia County, West Virginia. The purpose of this FYR was to determine if the remedial actions that have been implemented are protective of human health and the environment. The review process consisted of the following activities: notification and involvement of stakeholders, review of existing and relevant documentation and data, identification and review of recent and new information, and an assessment of site conditions. This report documents the review process and presents the findings, conclusions, and recommendations.

This FYR concludes that the remedial actions implemented at OU-1 of the OWDA site are protective of human health and the environment in the short and long term. The multi-layer RCRA landfill cap was determined to be currently effective in containing hazardous waste materials, the treatment wetland ponds appeared to be functioning as intended, and site access restrictions were found to be functional. Institutional controls ensuring long term protectiveness have been developed and have been fully implemented since the first FYR.

FIVE YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
SITE: Ordnance Works Disposal Areas Superfund Site		
EPA ID# WVD000850404		
Region: III	State: West Virginia	City/County: Morgantown/Monongalia County
SITE STATUS		
NPL Status: Final		Remediation Status: Complete
Multiple OUs? Yes		Construction Completion Date: 9-09-2003
Has site been put into reuse: Yes		
REVIEW STATUS		
Lead Agency: USEPA		
Author name: Christian Matta		
Author Title: Remedial Project Manager, USEPA Region III		
Review Period: 9/2006 to 8/2011		
Date(s) of site inspection: May 25, 2011		
Type of Review: Post-SARA		Review number: 2
Triggering Action: Signature of First Five Year Review		
Triggering action date: 9-18-2006		
Due date: 9-18-2011		
ISSUES No issues affecting protectiveness of the remedy were identified during this Five Year Review.		
Recommendations and Follow-up Actions There are no recommendations or follow-up actions associated with this Five Year Review.		

GPRA Measure Review:

As part of this Five-Year Review the GPRA Measures have also been reviewed. The GPRA Measures and their status are provided as follows:

Environmental Indicators:
Human Health: Current Human Exposure Under Control (HEUC)

Groundwater Migration: Contaminated Ground Water Migration Under Control (GMUC)

Site-Wide RAU:
The Site was determined to be Site-Wide Ready for Anticipated Use (SWRAU) on September 28, 2007.

Protectiveness Statement:

The PRPs have implemented the remedy at Operable Unit One in accordance with the remedial action objectives of the 1999 ROD, and it is currently functioning as intended. This Five Year Review found that the remedy is protective of human health and the environment.

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (USEPA), Region III, with assistance from the U.S. Army Corps of Engineers (USACE), Huntington District, and the West Virginia Department of Environmental Protection (WVDEP), conducted this Second Five-Year Review (FYR) of the Ordnance Works Disposal Areas Site (OWDA or Site), pursuant to the Comprehensive Environmental Response Compensation, and Liability Act (CERCLA), Section 121(c), National Oil and Hazardous Substances Contingency Plan (NCP) Section 300.400(f)(4)(ii), and OSWER Directives 9355.7-02 (May 23, 1991), 9355.7-02A (July 26, 1994), and 9355.7-03A (December 21, 1995). The Comprehensive Five-Year Review Guidance, EPA 540-R-01-007 (USEPA, 2001), was consulted in preparation of this FYR. This is a post-Superfund Amendments and Reauthorization Act of 1986 (SARA) remedial action, enforcement-lead response action, statutory review. The triggering action for this statutory review is the signature date of the First Five Year Review, September 18, 2006.

This document will become part of the site file and is the Second FYR for the OWDA site. This review evaluated the OU-1 remedial measures at the OWDA. The review process consisted of the following activities: (1) notification and involvement of stakeholders, (2) review of existing and relevant documentation and data, (3) identification and review of recent and new information, and (5) an assessment of current site conditions.

This report presents the methods, findings, conclusions, and recommendations for the FYR of the former OWDA. The purpose of the FYR is to ensure that a remedial action remains protective of human health and the environment and is functioning as designed.

USEPA and USACE prepared this FYR report pursuant to CERCLA Section 121(c) and the NCP, 40 CFR 300.430(f)(4)(ii).

CERCLA §121(c) states the following:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section {104} {106}, the President shall take or require such action. The President shall report to the congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

USEPA interpreted this requirement further in NCP, 40 CFR 300.430(f)(4)(ii) as:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

1.1 Purpose of Review

The primary purpose of this FYR was to evaluate whether the response actions undertaken at OU-1 are functioning as intended and remain protective of human health and the environment. Another objective was to identify and provide recommended remedies for any issues of concern associated with the implemented response actions. Section 121(c) of CERCLA, as amended by SARA, and §300.430(f)(4)(ii) of the NCP mandate that a post-SARA remedial action be reviewed no less often than every five years after initiation of the remedial action at sites where hazardous substances, pollutants, or contaminants remain at levels above those that allow for unlimited use and unrestricted exposure. This is the Second FYR for the OWDA site.

1.2 Site Overview

The OWDA is part of the former Morgantown Ordnance Works (MOW), and is located approximately one mile southwest of the city of Morgantown, West Virginia, along the west bank of the Monongahela River (See Figure1). The OWDA is often referred to as the MOW. The property on which OWDA is located consists of approximately 670 acres. It is currently owned by Morgantown Industrial Park (MIP), a commercial and industrial complex. For the purposes of environmental investigation and remediation, OWDA is made up of three segments:

1) OU-1 encompasses a small portion of the MOW formerly used for disposal of tar and other wastes;
2) Two tracts of land currently owned and operated by Crompton Corporation (purchased from General Electric (GE) Company in 2003). The tracts are known as the North Plant and South Plant. Crompton/GE properties are not covered under the Superfund Program, but are covered by Resource Conservation Recovery Act (RCRA) Corrective Action authorities.
3) Operable Unit 2 (OU-2) covers all other parts of MIP, including abandoned MOW production areas, never used parts of the property (undeveloped woodlands), and currently leased parcels.

1.3 Current Status of Operable Units

All OU-1 remedial action work has been completed as part of the overall requirements of the Administrative Order for Remedial Design and Remedial Action, Docket No. III-90-27-DC, signed by USEPA on June 20, 1990. The named Respondents are Rockwell International Corporation, Olin Corporation, GE Specialty Chemical, Inc., and Morgantown Industrial Park Associates, Limited Partnership (MIPA).

OU-2 encompasses the entire northern portion of the site which was used for chemical manufacturing and is currently known as the Morgantown Industrial Park. OU-2 is not included within the site's NPL boundary. OU-2 addressed the remainder of the property, not including the currently active Crompton/GE Facility, and was completed through a removal action performed in 1997 that included the following actions:

- Removal of water/debris from on-site sumps and pits;
- Off-site disposal of soils/sediments;
- Backfilling and re-vegetation of excavated areas; and
- Elimination of physical hazards.

USEPA has indicated that it does not expect further CERCLA responses for OU-2, as documented in the OU-1 ROD:

> "EPA does not anticipate further CERCLA response actions within OU-2 of the OWDA, expansion of the NPL listing to include OU-2, or issuance of a ROD for OU-2. Although cleanup actions deemed necessary by EPA at the GE properties within OU-2 will likely occur under RCRA, the Agency has reserved its right to perform or require CERCLA response actions in connection with such properties."

Since all of the contaminated material was removed, no operation and maintenance (O&M) of OU-2 is required.

2.0 SITE CHRONOLOGY

TABLE 1	
OWNERSHIP CHRONOLOGY	
1940 – 1945 E.I. Dupont de Nemours under lease to U.S. Government produced hexamine from Ammonia and methanol	**1962 – 1978** Purchased and operated by Morgantown Ordnance Works, Inc. Leased to Sterling/Rockwell. 1964, Borg Warner purchase
1945 – 1950 Sharon Steel and Heyden Chemical leased property for coke plant and ammonia production	**1978-1982** Purchased and operated by Princess Coals, Inc.
1951-1958 Olin Mathieson leased property and produced ammonia methyl alcohol, formaldehyde, hexamine and ethylene diamine	**1982** Purchased Morgantown Industrial Park Associates (MIPA), Limited Partnership
1958-1962 Facility remained idle	**1982-Present** Operated by MIPA

Table 2	
REMEDIAL ACTIVITIES/EPA DOCUMENTATION CHRONOLOGY	
1981 PCB Site Discovery. Two lagoons used for chrome plating waste disposal were excavated and disposed of by Rockwell Int'l	**1996** Sept: USEPA executed Consent Order for a Removal Action with the PRPs for OU-2
1982 October: State Site Investigations Sept: Preliminary Assessment	**1997** March: Treatability Studies for Bioremediation. Focused FS for OU-1 June: Removal Action complete for OU-2
1983 April: USEPA Region III Field Investigation Team (FIT) site inspection and sampling of aqueous and soil sediment and air samples	**1998** Sept: Focused FS approved by USEPA
1984 May thru June: PCB-containing drums disposed. July: USEPA Region V FIT Team site inspection	**1999** June: USEPA issues Proposed Remedial Action Plan identifying a new remedy for OU-1. Sept: Third (final) ROD
1986 June: Site added to National Priorities List	**2001** September: Implementation of the Remedial Action for the 1999 ROD. Feb: Final Design approved
1988 RI/FS completed. March: First ROD - selected cleanup actions for the disposal area of the plant, OU-1	**2003** July: Construction effectively completed September: Final Inspection
1989 June: Superfund Program Draft Proposed Plan Sept: Second ROD	**2006** First Five-Year Review

3.0 BACKGROUND

This document details a FYR conducted for the OWDA in Morgantown, West Virginia. The purpose of the FYR is to evaluate whether the response actions and original performance standards remain protective of human health and the environment. USEPA is the lead agency and decision-maker for OWDA. USEPA in consultation with the USACE and WVDEP conducted the FYR and prepared this report.

3.1 Physical Characteristics

The OWDA is located in Monongalia County, West Virginia, on the west bank of the Monongahela River approximately one-mile southwest of the city of Morgantown. The site lies within the Appalachian Plateau Physiographic Province of northern West Virginia. The topography surrounding the site is rugged and dominated by the Chestnut Ridge - along anticlinal mountain in the Allegheny Mountain Range located seven miles east of Morgantown. At the OWDA, the elevation of the ground surface in the areas investigated ranges from 975 feet above mean sea level (MSL) to 1010 feet above MSL. The Monongahela River is adjacent to the site at 825 feet above MSL, with a fairly steep cliff separating the river from the waste disposal area and former drum staging area. All surface runoff drains to the river. The actual land surface of the site has been altered by such activities as waste pond excavations, backfilling, removal of soil, and grading. Drainage swales that discharge both storm and surface water from the site extend beyond the fenced perimeter and ultimately discharge to the Monongahela River. The regional groundwater flow direction is also eastward towards the Monongahela River

3.2 Land Use and Resource Use

The original MOW property consisted of approximately 849-acres with the current site of approximately 670-acres owned by MIPA, approximately 24-acres owned by Monongahela Railway Company (an active railroad), and approximately 120-acres owned by various private companies or individuals. MIPA operates the site as a commercial and industrial complex by leasing property to various companies, and plans to continue to do so. Within one-mile of the site are several residences, one known private drinking water well, natural wetlands, livestock grazing areas, a junk yard, and Crompton employees located at the South Plant.

The landfill, treatment wetlands, and several shallow monitoring wells are within a fenced area with locked gates. A synthetic membrane cap was constructed over the former OU-1 landfill area in 2003. Ten groundwater monitoring wells exist around the capped area. Occasionally, a local resident's cattle escape from private pasture lands and graze in and around the swales and former lagoon area. MIPA employs a site superintendent who checks the property on a daily to weekly basis. The landfill and treatment wetlands area is not a likely candidate for redevelopment and institutional controls are in place preventing residential development in OU-1.

3.3 History of Contamination

The property where the OWDA is located has been occupied and used for a variety of chemical production and industrial operations since the 1940s. Beginning in October 1940, the property was operated by E. I. DuPont de Nemours and Company (DuPont) under contract to the U.S. Department of War (now Department of Defense (DoD)). DuPont produced hexamethylenetetramine (i.e. hexamine) from ammonia and methanol and small amounts of "heavy water". The waste products resulting from the coal-burning manufacturing process of ammonia and methanol were sulfur and light oil (75-percent toluene and benzene). The primary

on-site disposal area was the landfill in the southern portion of the facility, which was later designated as part of OU-1. In 1946, Sharon Steel operated a coke plant and Heyden Chemical operated an ammonia production facility. Beginning in 1951, Mathieson Chemical Corporation (now Olin Corporation) produced ammonia, methyl alcohol, formaldehyde, hexamine, and ethylene diamine at the site. Blue catalyst pellets that were used in the production of ammonia were disposed on the ground surface throughout the site.

The U.S. Government sold the property in 1962 to Morgantown Ordnance Works, Inc. This private corporation leased a portion of the site to Sterling Faucet; Rockwell International acquired all assets of Sterling Faucet in 1968 and in 1973 the two companies merged. Rockwell/Sterling operated a chrome-plating facility until 1976. Rockwell had constructed two lagoons adjacent to the existing landfill to dispose of chrome-plating wastes. Princess Coals, Inc., acquired the property from MOW, Inc., in 1978, but did not actively lease or operate a chemical production facility. The MOW property was acquired from Princess Coals by a group of private individuals in 1982 that became Morgantown Industrial Park, Inc. and subsequently changed its name to Morgantown Industrial Park Associates, Limited Partnership (MIPA). MIPA continues to lease parcels to commercial businesses located in the industrial park.

In 1964, Weston Chemical Company, Inc., had purchased certain parcels of property from the industrial park and began operation of an organic chemical production facility. Weston was later acquired by Borg-Warner Chemical Corporation. In 1988, GE purchased the stock of Borg-Warner Specialty Chemicals, Inc., and the name was subsequently changed to GE Specialty Chemicals, Inc. (the North and South Plants). This 62-acre GE facility became Crompton Corporation in August 2003. The Crompton facilities are currently active, although GE Chemical has an agreement with USEPA to remediate under RCRA Corrective Action authorities.

The northern section of OU-1 was an abandoned, inactive landfill that was estimated to have a fill depth of 20 feet below-ground-surface (bgs) at its thickest location. No records exist on the quantities or types of material disposed of in the landfill. Eyewitness reports and direct observations revealed that the landfill contains construction debris, slag, ash, and catalyst pellets. Leachate from the landfill drained to the northeast into an existing wetland. The wetland drained directly to Swale 3, which eventually discharged into the Monongahela River. The sediment layer of both the wetland and the upper portion of Swale 3 were determined during the pre-design sampling event to have been impacted by heavy metals.

3.4 Initial Response

As a result of the chemical and industrial activities that occurred during the property's history, hazardous substances were generated, stored, and ultimately disposed of on the southern portion of the industrial park, thereby creating a landfill. This disposal area became known by USEPA as OU-1. OU-1 is a roughly six-acre site located approximately 0.5 miles south of the original main plant area and includes: (1) a Landfill, (2) Lagoons, (3) a "scraped area" used for shallow disposal of wastes, (4) a drum staging area, and (5) several streams with associated wetlands.

Studies and remedial activities at the disposal site began in 1981. Oils, some contaminated with various levels of polychlorinated biphenyls (PCBs) from abandoned transformers used during the industrial activities at the OWDA, were stored in approximately 38 drums at various locations in the vicinity of the landfill/lagoon area. In addition, transformers and switch tanks, some of which contained no liquid reservoirs but were contaminated with PCBs, were discovered on the OWDA. A portion of the former Lagoon Area was excavated in 1981 to address metal-plating wastes disposed in two surface impoundments by Rockwell between 1970 and 1976. During this removal action, miscellaneous wastes including coal tars were observed in the lagoon. The site was first inspected by the USEPA Region III Field Investigative Team (FIT) in April 1983. The oil-containing drums and carcasses were removed and disposed of in 1984. A follow-up inspection was performed by the USEPA Region III FIT in July 1984. The area referred to as OU-1 was proposed for inclusion on USEPA's National Priorities List (NPL) on October 15, 1984 (47 FR 58476). USEPA divided the site into two areas or Operable Units:

(a) OU-1
- Inactive landfill
- Two lagoons and surrounding impacted area
- A 'scraped area' used for shallow waste disposal,
- Former drum staging area

(b) OU-2
- All former chemical manufacturing areas excluding the currently active Crompton/GE facility.

Final listing on the NPL occurred on June 10, 1986 (48 FR 40674). The named Potentially Responsible Parties (PRPs) were Rockwell International Corporation, Olin Corporation, GE, and MIPA.

The RI/FS was completed in 1988. As part of the 1988 RI/FS report, USEPA prepared an Endangerment Assessment (EA) for the OWDA, but Ecological Risks (e.g., the threats to organisms in the streams and wetland) were not evaluated at that time. Sampling events on the property during the Remedial Investigation (RI), the Phase II Interim Design Tasks, and Feasibility Studies (FS) occurred in various phases between 1980 and 1998. Sampling included groundwater, surface and subsurface soils, surface water, and sediment.

3.5 Basis For Taking Action

As part of the 1988 RI/FS report, USEPA prepared an EA for the OWDA in order to identify and define possible existing and future human health risks associated with exposure to the contaminants present in the various media at OU-1. The surface and subsurface soils, surface water, and sediment of OU-1 were all impacted to varying degrees by organic and inorganic contaminants. RI test pits in the Scraped Area revealed cinder-like backfill material, blue and black catalyst pellets, and yellow solid material.

USEPA considered the impact of site-related contamination on human health for both present and future potential exposure pathways and concluded that OU-1 presented an unacceptable risk

to human health from soil and sediment contamination. Groundwater was not found to present an unacceptable risk. There were no MCL exceedances in either the 1986, 1987 or 1998 groundwater sampling events. The groundwater was not used as a drinking water source.

Additional borings in the Scraped Area exposed visible tar from ground surface to a depth of eight-feet below ground surface (bgs) and detected concentrations of total carcinogenic Polynuclear Aromatic Hydrocarbons (cPAHs) ranging from 94 parts-per-million (ppm) to 36,000 ppm. Some elevated levels of inorganic contaminants were detected in the 1988 RI but were not detected in the scraped area during the 1996 Phase II Interim Design Tasks. Further investigation during the Phase II Interim Design Tasks indicated cPAH concentrations ranging from 3.2 to 30,000 ppm, however, the inorganic contaminants detected during the 1988 RI were again not noted.

In August 1998, following a review of the 1988 RI data, USEPA's Biological Technical Assistance Group (BTAG) concluded that inorganic contaminants were present in surface water and sediments within OU-1 at levels that are acutely toxic to potentially affected ecosystems. BTAG agreed that environmental protectiveness would be achieved if inorganic compounds in specific drainage areas (swales) were cleaned up to background levels. There was no evidence that contamination from the OWDA affected the Monongahela River.

4.0 OU-1 REMEDIAL ACTION

As a result of the manufacturing operations conducted at the OWDA, hazardous substances were generated and subsequently disposed at OU-1. During the RI/FS in 1988, it was determined that the surface and subsurface soils, surface water and sediment of OU-1 were all impacted to varying degrees by organic and inorganic contaminants such as heavy metals and PAHs.

OU-1 is approximately six acres, is located approximately 0.5 miles south of the original main plant area, and was formerly used as a waste disposal area. OU-1 includes the following:

- Landfill: The northern section of OU-1 was an abandoned, inactive landfill estimated to have a fill depth of 20 feet at its thickest location. No records exist on quantities or types of material disposed of in the landfill. Waste materials identified on-site include construction debris, slag, ash, and catalyst pellets. Leachate from the original inactive landfill drained to the northeast into an existing wetland.

- Lagoons: Two lagoons, formerly used for chrome-plating waste disposal between 1970 and 1976, were excavated and disposed of in an approved landfill by Rockwell International in 1981.

- Scraped Area: This area was used for shallow disposal of wastes. The wastes identified were construction debris, oil-like stained soils, tar, and catalyst pellets. Chemical analyses of soil and fill material in the scraped area indicated concentrations of metals, cPAHs, and arsenic.

- Drum Staging Area: Drums that were originally scattered throughout the site were collected, staged, and sampled in 1984 in the drum staging area.

- Streams: Three streams pass through the site. Analytical samples from surface water indicated relatively low concentrations of cPAHs, arsenic, lead copper, chromium, zinc, cadmium, and mercury, the parameters of concern. However, cPAHs were detected at relatively high concentrations at sediment sampling locations down-gradient of the Scraped Area and Landfill.

4.1 OU-1 Remedy Selection

Three RODs have been signed for OU-1. The remedies described in the 1988 and 1989 RODs were not implemented. The remedy in the 1999 ROD was implemented and is the focus for this FYR.

4.1.1 1988 Record of Decision

The remedy selected in the 1988 ROD, onsite incineration and containment, focused on source control of soils and sediments contaminated with cPAHs and heavy metals. The remedy required on-site incineration with containment to treat contaminated soils found in the former Lagoon Area and the Scraped Area, as well as sediments found in the settling zones of the three streams down-gradient of the waste management area. The remedy required the construction of a multi-layer RCRA cap on the inactive landfill, required 30-years of monitoring and an assessment of impacts of the remedial action to existing wetlands along with wetland mitigation.

4.1.2 1989 Record of Decision

USEPA determined that PRPs had not received notice of the original OU1 proposed plan and opened an additional thirty-day comment period for responsible parties to comment on the ROD. Based on comments received during this period, USEPA conducted a focused FS in 1989 to re-evaluate the alternatives described in the March 1988 ROD and to conduct a risk-based analysis of cleanup levels.

During this analysis, USEPA specifically focused on eight contaminants: cPAHs, arsenic, cadmium, chromium, copper, lead, mercury, and zinc. The focused FS was completed in June 1989. A new ROD was issued by USEPA in September 1989, which selected a "preferred" and a "contingency" remedial action for OU-1. The preferred remedy included treatment of organic contaminants using bioremediation and the contingency remedy utilized soil washing.

In June 1990, USEPA issued an administrative order requiring the PRPs to implement the remedy described in the 1989 ROD. USEPA later agreed to adopt a less stringent cleanup level for cPAH cleanup, due to a change in the cancer potency factor for benzo(a) pyrene in USEPA's Integrated Risk Information System (IRIS). In March 1997, the treatability studies for bioremediation were completed. It was determined that bioremediation was not cost-effective and could not meet the cleanup standards set in the ROD within a reasonable timeframe. USEPA

and the PRPs agreed that the soil washing contingency action was also deficient and a second focused FS was conducted in 1997-1998.

4.1.3 1999 Record of Decision

USEPA issued another ROD in 1999 selecting a new preferred remedy for OU-1 based on the results of a second focused FS. The following remediation objectives were included in the 1999 ROD:

- Eliminate the potential for direct contact with organic contaminants in surface and subsurface soils and sediments that exceed the cPAH Cleanup Standard;
- Eliminate the potential for direct contact with inorganic contaminants in surface and subsurface soils that exceed risk-based cleanup standards established in the September 1989 ROD;
- Reduce or eliminate inorganic contaminants in sediments to the cleanup levels set forth in Table 7 of the ROD;
- Reduce the potential for organic and inorganic contaminants in surface and subsurface soils and sediments to migrate to the groundwater or to migrate offsite;
- Reduce or eliminate the threat of direct contact with contaminants in the landfill; and
- Reduce or eliminate the threat of migration of contaminants from the landfill.

This new ROD for OU-1 was finalized in 1999 and included the following actions as part of the selected alternative, Alternative 5:

- Excavation of all visibly stained tar-like material from the Lagoon Area, Scraped Area, and stream sediments and transportation of this visibly contaminated waste material to an off-site thermal treatment facility for treatment;
- Excavation of all soils contaminated with cPAHs in excess of the cPAH Cleanup Standard and soils contaminated with inorganic compounds in excess of the inorganic cleanup standards set in the September 1989 ROD from the Lagoon Area and the Scraped Area and consolidation of this contaminated soil into the existing landfill;
- Excavation of all sediments contaminated with cPAHs in excess of the cPAH Cleanup Standards and sediments contaminated with inorganic compounds above background levels from the wetland area and drainage swales 1, 2, and consolidation of these sediments into the existing landfill;
- Backfilling, re-grading, and re-vegetating the excavations in the Lagoon Area and the Scraped Area;
- Restoration of streams and wetland areas where sediment was excavated;
- Construction of a multi-layer RCRA cap over the existing landfill;
- Long-term monitoring of sediment, streams and groundwater;
- Maintenance of the existing perimeter fence; and
- Implementation of institutional controls to protect the cap and prohibit residential development, recreational use, schools and child care facilities.

The cleanup standards for the 1999 ROD are attached as Table 6 and Table 7. Neither the March 1988 ROD nor the September 1989 ROD required actions for groundwater. There was no evidence that the groundwater had been significantly impacted by disposal operations at OU1 and no unacceptable risks were posed to receptors of the groundwater at OU1. Therefore, the remedy selected in the 1999 ROD did not include a groundwater remediation component.

4.2 Remedy Implementation

Based on the final ROD, the Pre-Design Work Plan and Pre-Design Investigation Report were prepared and submitted to USEPA by Environmental Strategies Corporation (ESC) in August 2000 and January 2001, respectively. Upon approval, the PRPs prepared the remedial design to guide the construction of the remedy. The remedial action specified in the 1999 ROD was divided into two segments in order to expedite implementation. The Tar and Soil Excavation Work Plan was approved by USEPA in July 2001. This allowed excavation to begin in September 2001 while the cap was being designed. The Final Design Report for construction of the cap was submitted to USEPA in April 2002. The cap was not constructed until all excavation was complete. The work plans for both the replacement and treatment wetlands were appended to the Final Design Report.

ESC served as the general contractor and engineer for most of the remedial action. ESC was responsible for planning, oversight, reporting, sampling, and engineering. Sevenson Environmental Services (SES) excavated and reconstructed the swales and constructed the landfill cap. Kipin Industries was responsible for excavation, processing, and coordinating off-site thermal treatment of tar and transportation of soil to the landfill. Grant Tower Power Plant (GTPP) received and treated the processed tar by using it as fuel. Ecological Restoration, Inc., (ERI) designed and built the treatment wetlands and the replacement wetland.

4.2.1 Site Preparation

SES first cleared and grubbed the area and improved the access road. A tar processing area was constructed. Large vegetation was removed from the swales, and trees and stumps were ground and mixed into the landfill sub-grade.

4.2.2 Excavation

Excavation of tar and soil in the lagoon, swales and scraped area began on September 18, 2001 and was completed on August 1, 2002. Tar and tar-like materials were excavated and stockpiled separately from impacted soils, which were defined as soil that had no visible tar present but PAH or metals content suspected to be above the cleanup standards. This impacted soil was transported to the on-site landfill for disposal, while the tar and tar-like materials were kept on-site for processing. The excavation area had been divided into cells, and confirmation samples were taken from each wall and floor of the open cells to determine if the cells were "clean" and could be backfilled. If the cell was not clean, excavation continued. In some cells, excavation continued to a depth of nearly 30-feet bgs, due to the discovery of free-phase oil. In the Scraped Area, excavation volumes were more than double the original estimate due to construction debris

being encountered. This material was placed into the landfill, because it did not include any tar or tar-like material.

Free-phase oil was discovered in the Lagoon Area in clay and rock. Approximately 10,000 cubic yards (CY) of soil and shale were excavated down a maximum depth of approximately 30 feet bgs. The oil appeared to be trapped within the layers of horizontal shale fractures, occasionally percolating through vertical fractures.

Two mounded areas near the scraped areas were investigated. Approximately 50 CY of tar was found in one of them, and approximately 800 CY of material was excavated. Confirmation samples verified that no additional tar in one mound required excavation. No excavation was necessary in the other mound, based on test pits. Small, isolated pieces of tar from throughout the site were processed in the same manner as the other tar material.

During excavation of the three swales, tar was found only in Swale 1. Excavation down to six-feet bgs was required to remove the tar. Swales 2 and 3 were excavated to a depth of two-feet bgs. Also, the existing wetland at the intersection of Swale 3 and the railroad track was excavated. This is the wetland to which leachate from the former landfill drained. Excavation ceased when wall and floor confirmation samples yielded results below cleanup levels required by the 1999 ROD.

A total of approximately 45,000 CY was excavated, with 40,000 CY placed into the on-site landfill and approximately 5,000 CY of tar, tar-like material, and coke breeze mixed with additives shipped to Grant Town Power Plant (GTPP). From the Scraped and Lagoon Areas, approximately 27,000 CY was excavated. About 10,000 CY of sediment was removed from the swales. SES removed 3,000 CY as part of the final work area excavation.

4.2.3 Processing of Tar and Tar-Like Material

Tar and tar-like material was stockpiled and mixed with additives to achieve the necessary 7,580-British Thermal Unit (BTU) value and shipped to GTPP for use as a coal waste synfuel. The first shipment was made in October 2001. Tar processing activities were completed in July 2002 with the last of the product shipped to GTTP in August 2002. A total of 14,623 tons of product was shipped.

4.2.4 Landfill Cap

During the summer and fall of 2002, the existing landfill material and excavated material and sediment were graded and compacted to meet the final design contour. The final cover system consisted of (1) a vegetated top cover 24-inches thick, (2) a lateral drainage layer of non-woven geosynthetic filter fabric bonded to both sides, and (3) a low-permeability layer with a 40-mil upper component and a geosythetic clay liner as the lower component. A gas vent layer was constructed at the highest point of the cap (ridge) and consisted of a stone trench and pipe for gas emissions. A leachate collection and conveyance system was constructed to collect leachate with initial leachate infiltration collected with a 4-inch high density poly-ethylene (HDPE) corrugated perforated pipe and transferred to a 4-inch HDPE corrugated solid pipe for ultimate conveyance

to the constructed wetlands. Placement of the final cover system began in May 2003 and was completed in July 2003. Drainage ditches were created around the perimeter of the cap to convey surface runoff and silt fencing was installed on the cap's face as a temporary measure prior to establishment of vegetation. Landfill leachate is treated by use of constructed treatment wetlands that are located below the leachate collection system at the toe of the landfill.

4.2.5 Treatment Wetlands

A collection system captures any leachate produced within the landfill and funnels it to a series of three constructed wetlands (also referred to as Ponds 1, 2 and 3 or cells 1, 2 and 3). These wetlands were completed prior to the landfill cap. The first pond is primarily a settling basin for heavier particulates. It has a limestone bed covered with organic compost. The leachate flows through the limestone, which helps precipitate out any iron. Cattails were established to ensure aerobic conditions and dissuade wildlife from entering.

The second pond is constructed of a two-foot limestone bed, two feet of leaf compost mixed with crushed limestone, and two feet of water. Water enters at the surface and flows downward to a collection pipe beneath the limestone layer. The purpose of this pond is to allow sulfate-reducing bacteria to thrive, which will reduce zinc and copper concentrations. This pond requires anaerobic conditions, therefore it contains no plants. Ongoing maintenance is required to ensure that this pond remains free of vegetation.

The third or polishing pond removes any remaining metals and biochemical oxygen demand (BOD) from the leachate. This shallow pond was planted with cattails to dissuade wildlife from entering it.

After leachate is processed through the final treatment wetland, effluent then drains from the wetland area to an area directly below the treatment wetlands referred to as Swale 3. Below Swale 3 is a functioning railroad track with an existing tile/culvert running under the track. After exiting the culvert, water continues to drain down an embankment, toward the river floodplains and eventually to the Monongahela River.

4.2.6 Replacement Wetland

Seven-tenths of an acre of existing wetlands was lost in the vicinity of swale 3 as part of the remedial action, and were replaced with 1.05 acres of wetlands along the Monongahela River in 2002.

4.3 Systems Operation/O&M

Site O&M requirements are contained in the Revised Final Operations and Maintenance/Post Closure Plan. This plan includes inspection of the landfill cover, wetlands, and associated drainage systems and sampling requirements for groundwater and treatment wetland effluent. Additionally, sampling of the treatment wetlands effluent and groundwater is currently performed on a semi-annual basis.

4.3.1 Treatment Wetlands Inspection

The treatment wetlands were initially inspected every six months during the first two years of the O&M period. Presently, the wetlands are being inspected annually. In order for the wetlands to operate as intended, vegetation must be kept out of Pond 2 to maintain anaerobic conditions but should flourish in Ponds 1 and 3 to ensure aerobic conditions and deter wildlife.

The treatment wetlands continue to be inspected and maintained to control establishment of plants in Pond 2 and ensure flow through of leachate in the pond system. Nesting and borrowing animals have been controlled when possible. The integrity of the treatment ponds system has been monitored and has not required modification to date.

During the May 2011 FYR site visit, the ponds appeared to be in good condition, but the effluent from Pond 3 appeared black. This has been attributed to the naturally-occurring manganese that has been detected in the groundwater. Ponding of effluent after Pond 3 and a seep indicate that the flow path of the treatment wetlands may be impeded. Evidence of burrowing from muskrats was noted and monitoring for potential adverse affects of burrowing on the integrity of the treatment wetlands ponds should be conducted. Monitoring of the treatment wetlands should continue and periodic monitoring of the landfill leachate should be conducted both prior to the treatment wetlands and after the wetlands to ensure the treatment wetlands are performing correctly.

4.3.2 Replacement Wetlands Inspection

The mitigation wetland was inspected every six months during the first two years of the O&M period. It was first inspected in August 2004 and is currently inspected annually.

Beginning in 2008 the PRPs undertook efforts to eradicate invasive plant species from the replacement wetlands at the request of the EPA and WVDEP. Personnel from EPA's BTAG have inspected the replacement wetlands every spring to mark invasive plant species for removal during normal landfill cap maintenance activities. The efficacy of the invasive plant species removal efforts has been successful and should continue.

4.3.3 Landfill Inspection

A landfill inspection checklist was developed as part of the original O&M plan and is completed during inspections along with photo documentation. Inspections currently occur on a semi-annual basis. During the May 2011 FYR inspection the landfill cap appeared in good condition and did not have apparent areas of erosion or areas of distressed vegetation. No cracking and or movement of surficial soils was evident on the top of the landfill cap slope. Storm-water conveyance channels appeared in good condition and no obvious signs of ponding water were evident throughout. Overall the vegetative cover was robust and well established.

4.3.4 Progress Since Last Five Year Review

This is the second FYR for this site. The First Five Year Review determined that the PRPs have implemented the remedy at Operable Unit One in accordance with the remedial action objectives of the 1999 ROD, it is currently functioning as intended and the remedy is protective of human health and the environment in the short term. EPA identified implementation of institutional controls as the one recommendation requiring a follow-up action that affected the long term effectiveness of the remedy. Implementation of institutional controls was completed on September 12, 2006, with the recording of the Environmental Covenant in the office of the Clerk of the County Commission of Monongalia County, West Virginia in Deed Book 1327, at Page 557.

The First FYR report also made recommendations to improve O&M activities such as addressing eroded areas, re-establishing vegetative cover, and ensuring surface water runoff controls are adequately maintained. The PRP group addressed the recommendation to install movement markers on the landfill slopes and institute a monitoring program on May 29th, 2007. The PRP group had the landfill evaluated to determine if movement markers were needed. Based on the report from that evaluation as well as the evaluation of the Interface Friction Test Results done on the landfill cap liner material during the Remedial Design, it was determined that movement markers are not necessary.

The First FYR also identified an area of distressed vegetation and erosion on the landfill cap and areas of ponding water. On November 10, 2006, the PRPs mobilized a contractor to place additional topsoil on areas of the landfill cap to address erosion and ponding water. Those areas were then seeded and fertilized to establish vegetation. No problems were noted in those areas during this Second FYR. On December 5th and 6th of 2006, re-grading of surface water runoff ditches was undertaken to improve drainage and control erosion.

5.0 FIVE-YEAR REVIEW PROCESS

This FYR consisted of the following activities: the involvement of stakeholders, the review of existing and relevant documentation and data, the identification and review of recent and new information, an initial assessment of site conditions, actions taken by the PRPs to resolve deficiencies, an inspection, and the preparation of this report.

5.1 Administrative Components

This FYR was conducted by USEPA Region III with assistance provided by USACE Huntington District and the West Virginia Department of Environmental Protection.

5.2 Stakeholder and Community Notification and Involvement

Notification of stakeholders of the FYR was performed by USEPA Region III. An advertisement was placed in the Dominion Post on Thursday, March 10 2011 notifying the

public of the preparation of the Five-Year Review Report. A similar notice shall be placed in the same paper informing the public of the completed report with a description of where the report can be located.

5.3 Document Review

Reviews of relevant documents including RODs, correspondence, and O&M records, were conducted as part of this FYR. Remediation levels identified in RODs were also reviewed, and Applicable or Relevant and Appropriate Requirements (ARARs) and toxicity factors were checked for updates.

The following Site related documents were reviewed for this Second Five Year Review.

- March 1988 Record of Decision for the Ordnance Works Disposal Areas Site
- September 1989 Record of Decision for the Ordnance Works Disposal Areas Site
- September 1999 Record of Decision for the Ordnance Works Disposal Areas Site
- Environmental Covenant Ordnance Works Disposal Areas Site, Operable Unit NO.1, Morgantown, West Virginia, September 12, 2006
- First Five-Year Review Report for the Ordnance Works Disposal Areas Site, September 18, 2006
- Update on Implementation of Items identified in the Five Year Review for the Ordnance Works Disposal Areas Site, June 25, 2007
- November 2008 through September 2010 Quarterly Operation and maintenance Reports, Ordnance Works Disposal Areas Site, Morgantown, WV

5.4 Data Review

As part of the ongoing Operation and Maintenance activities the treatment wetlands and groundwater are sampled to ensure the remedy components are functioning as designed.

5.4.1 Wetlands Effluent Sampling

Effluent from the treatment wetlands was monitored quarterly through November 2008 after which semi-annual sampling began in April 2009 and is ongoing. The effluent must meet regulatory criteria established by the WVDEP Office of Water Resources (OWR). Effluent samples are analyzed for chemical oxygen demand, total organic carbon, total suspended solids, total phenols, cPAHs, cyanide (free and total), total and dissolved iron, copper, zinc, and hardness.

The effluent is analyzed for semivolatile organic compounds (SVOCs), and no SVOC has been detected above the Method Detection Level (MDL). Total recoverable phenolics levels during the review period for this Second FYR were not consistently detected and estimated concentrations that were detected were far below the regulatory criteria of 2.56 ug/L. The effluent has remained in the acceptable pH range of 6-9 for all events for both the Second FYR periods. Although there are no criteria included in the O&M reports for total suspended solids, chemical oxygen demand, or total organic carbon, they are also monitored. The estimated total

cyanide levels during this Second FYR period have been consistently below the regulatory limit of 0.005 ug/L. Iron levels exceeded the regulatory limit of 1,500 ug/L on three occasions during the Second FYR period and were found to be as high as 3,450 ug/L. The regulatory level for both dissolved and total copper was never exceeded during the Second FYR period. Zinc, both total and dissolved, have not exceeded the regulatory levels during this Second FYR period.

Based on this data, it appears that the treatment wetlands have adequately treated any leachate from the landfill since they became established.

5.4.2 Groundwater Sampling

To ensure that the landfill cover is functioning properly and leachate and groundwater contamination are not discharging, a monitoring program is in place. Since December 2006 the groundwater monitoring wells have been sampled semi-annually. Currently, 10 monitoring wells are included in this sampling program (See Figure 2). The groundwater samples are analyzed for Semi Volatile Compounds (SVOCs) and Target Analyte List (TAL) metals. Tables 3 through 5 and Figures 3 and 4 are attached and indicate the sample results for this FYR period.

Shallow Monitoring Wells

Sample results indicate that SVOCs consistent with coal tar contamination were detected in shallow wells MW1, MW2 and MW6 during two of the eight sampling events for this Second FYR. Low level concentrations of various SVOCs were detected in MW1 during the November 2009 sampling event. During the March 2008 sampling event MW2 and MW6 had low level detections for several SVOCs. However, sample results for the primary and duplicate samples collected at MW6 for the March 2008 sampling event differ significantly, indicating that these results are anomalous.

Four inorganic constituents were found to exceed the Maximum Contamination Level (MCL) or Regional Screening Level (RSL) in shallow monitoring wells during this Second FYR review: Arsenic, Iron, Manganese, and Thallium (See Attached Table 5). Shallow well MW-1 contained concentrations of Manganese above the regulatory limit of 880 ug/L during the September 2007 and April 2010 sampling event. Shallow well MW-2 contained Manganese at concentrations exceeding the regulatory limit of 880 ug/L during all sampling events for this Second FYR. Thallium was also detected in shallow well MW-2 during the November 2006 and March 2007 sampling events at concentrations exceeding the MCL of 2.0 ug/L. Arsenic was detected above the MCL of 10 ug/L in shallow well MW-4 during the September 2007 sampling event. Manganese was found to exceed the regulatory limit of 880 ug/L in shallow well MW-4 during all sampling events. Shallow well MW-5 contained Manganese concentrations that exceeded the regulatory limit of 880 ug/L during the September 2007, September 2008, April 2009 and November 2009 sampling events. Shallow well MW-6 contained Manganese concentrations exceeding the regulatory limit of 880 ug/L during all sampling events. Thallium was detected in shallow well MW-6 during the March 2007 sampling event and in the March 2008 duplicate sample at levels exceeding the MCL of 2.0 ug/L. The primary MW6 sample from the March

2008 sampling event differs significantly from the duplicate sample collected for the same monitoring event. As a result the samples from MW-6 for the March 2008 sampling event are considered inaccurate.

The detections of Arsenic, Iron, Manganese, and Thallium are consistent with concentrations and frequency of detections seen during the First FYR period. Background shallow well MW-6 concentrations of these inorganics and the lack of increasing trend in concentrations indicates that the landfill is functioning as designed and is not a significant source of contamination to the groundwater.

Bedrock Wells

Sample results indicate that other SVOCs consistent with coal tar contamination were detected in bedrock wells DGW3R and DGW6 during two of the eight sampling events for this Second FYR. During the September 2008 sampling event and the November 2009 sampling event DGW3R had low level detections for several SVOCs. Bedrock well DGW6 had low level detections of several SVOCs during the November 2009 sampling event (See Attached Table 4).

The low level detections of SVOCs in the bedrock monitoring wells is consistent with monitoring results from the First FYR and are consistent with past production and disposal practices associated with coal tar

Bedrock well DGW-3R contained Thallium at concentrations exceeding the MCL of 2.0 ug/L during the November 2006 (6.8 ug/L), March 2007 (5.2 ug/L) and March 2008 (6.8 ug/L) sampling events. Thallium was not detected during any other round during this Second FYR.

Based on the sampling data from this Second FYR, the cap appears to prevent leaching of contaminants into the groundwater. For the analyzed parameters (SVOCs and TAL metals), there is no significant increase in the landfill monitoring wells to levels above regulatory criteria. Detections of some site related contaminants in the bedrock wells are not consistent and do not indicate contamination as a result of the landfill. The concentrations of contaminants detected above the respective RSL values have not been increasing in an appreciable manner. The groundwater is not used as a drinking water source and the September 12, 2006 Environmental Covenant prohibits use of the groundwater for potable and non-potable purposes.

5.5 Interviews

No community interviews were conducted as part of this Second FYR. Representatives from WVDEP and the PRPs were present and participated in the Five Year Review Site Inspection. During the inspection attendees discussed issues and recommendations relating to ongoing Site activities. The Participants agreed that the Operation and Maintenance Plan currently in place should be revised to reflect changes in the Operation and Maintenance practices and schedule.

5.6 Site Conditions Inspection

The PRPs inspect the remedy at OU-1 and sample groundwater and wetland effluent in accordance with the approved *Revised Final Operation and Maintenance/Closure Plan* as well as the *Revision 1 Remedial Action Quality Assurance Project Plan and the Revised Final Sampling Plan*. The inspection results are forwarded to the USEPA and WVDEP Project Managers (PMs). The USACE Hunting District personnel and WVDEP personnel provide oversight during site inspections and groundwater sampling

On May 25, 2011, representatives from USEPA Region III, WVDEP, and USACE Huntington District inspected OU-1 for this FYR. An eroded area was noted in the scraped area vegetative cover. Burrowing animals were noted around the treatment wetlands and the flow path of water leaving the treatment wetlands may be impeded a short distance from the effluent pipe. These conditions were noted to the PRPs who took corrective action on August 16, 2011 by 1) covering the eroded area with soil and seed to establish vegetation, 2) assessed the impacts of the burrowing animals and determined that the location and number of burrows would not cause harm to the treatment wetlands, and 3) addressed the treatment wetlands flow path through the removal of silt to clear the effluent drainage way. The PRPs have scheduled a follow-up site visit to assess the effectiveness of the revegetation effort and take additional measures to revegetate, if necessary, on or about October 24, 2011.

6 TECHNICAL ASSESSMENT

6.1 Question A: Is the remedy functioning as intended by the decision documents?

Yes, the remedy is functioning as intended by the decision documents. All construction associated with the ROD is complete. The results of this Second FYR indicate that the remedy is functioning in accordance with design documents. The excavation and capping of contaminated soil has achieved the remedial objectives of preventing or minimizing the potential for human exposure to contaminated soil and groundwater and of preventing or minimizing the potential for future off-site migration of contaminants. Since the completion of the remedial action activities, the following site conditions relating to the implementation of the selected remedy have been achieved:

- The fence is intact and in good repair;
- The landfill cap remains intact;
- The monitoring wells are functional; and
- There is no evidence of excessive trespassing or significant vandalism.

Based on the semi-annual O&M sampling, the cap appears to prevent leaching of contaminants into the groundwater. There is no significant increase in the levels of SVOCs and TAL metals in the landfill monitoring wells when compared to water regulatory criteria. The treatment wetlands are a passive treatment wetland system consisting of three cells (Ponds 1, 2, and 3) located at the toe of the landfill cap to treat leachate from the landfill. Pond 2 requires regular maintenance during warmer weather to remove aquatic vegetation. Field observations during the

regular inspections include (1) recording wildlife occurrences within the system habitat and the potential for wildlife exposure to residual leachate, (2) assessment of sedimentation and erosion, and (3) assurance of adequate aquatic vegetation in Ponds 1 and 3 and to confirm negligible or non-existent aquatic vegetation in Pond 2. The effectiveness of the treatment wetlands is being monitored semi-annually.

Maintenance activities related to the landfill, treatment wetlands, and fence are addressed in the post-construction monitoring program. Oversight by USACE Huntington District has determined that the sampling and treatment wetland activities are being properly carried out. Regular maintenance such as mowing when needed, removal of silt from drainage areas, and re-vegetation of barren areas must continue to be performed.

6.2 Question B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy still valid?

Yes, the exposure assumptions, toxicity data, cleanup levels, and RAOs used at the time of the remedy are still valid. During this review, it was necessary to consider the four following types of assumptions made in the OU-1 ROD and how those assumptions may differ at the present time:

- Standards and "to be considereds" (TBCs);
- Cleanup levels;
- Exposure pathways; and
- Toxicity and other contaminant characteristics.

The cleanup levels were included in the 1999 ROD and are attached as Tables 6 and 7.

6.2.1 Standards and TBCs

Twenty-three Applicable or Relevant and Appropriate Requirements (ARARs) are identified in the 1999 OU-1 ROD. The two location-specific ARARs applied only during construction of the remedial action, so they cannot be reviewed. Of the 21 action-specific ARARs, 12 applied only during implementation of the remedial action, and therefore cannot be reviewed. The West Virginia (WV) Groundwater Protection Act, 47 CSR 58-4.2, applies to the installation of monitoring wells, which has been completed, and the abandonment of monitoring wells, which is a future action; any future abandonment of wells shall comply with these regulations. Four of the ARARs are RCRA sections and only one of those, 40 C.F.R. § 265.117 Post-closure care and use of property as hazardous waste management units, had been amended since the signing of the ROD. The changes made to 265.117 are not substantial and therefore do not impact the selected remedy. The four remaining ARARs are WV state regulations. Portions of the WV Air Pollution Control (45 CSR 4) and Groundwater Protection Acts (47 CSR 58-4.9.d to 4.9.g and 47 CSR 58-8.1(c)) have not been amended since the ROD was signed. The WV Environmental Quality Board establishes criteria for surface water quality via 46 CSR 1. This regulation has undergone several changes since the signing of the 1999 ROD, but the only pertinent, significant change is the requirement to analyze discharges for dissolved copper instead of total copper. Since sampling began in August 2003, the effluent from the treatment wetlands has been

analyzed for both total and dissolved copper. There have been no other significant changes to the standards or TBCs since the 1999 ROD was signed that require changes to the remedy.

6.2.2 Cleanup Levels

Cleanup standards shown in the 1999 ROD are all risk-based. Although some modification to exposure assumptions or toxicity criteria may have occurred, the standards selected in the ROD are still protective. Further, the landfill is fenced to control access to the landfill cap and treatment wetlands. The Environmental Covenant provides for Institutional Controls that limits use of the property to commercial/industrial uses.

6.2.3 Exposure Pathways

Three exposure pathways that were used in the 1999 ROD: ingestion of soil/sediment, dermal contact, and inhalation of dust are still accurate. No groundwater exposure pathway existed since groundwater at and downgradient of OU1 was not used as a drinking water source. The future use scenario was evaluated in the 1999 OU-1 ROD with an industrial worker being the affected receptor, which is still accurate. If these standards were achieved, USEPA determined that the combined carcinogenic risk from exposure to arsenic and cPAHs will be 5×10^{-5}. This value is within the range of 1×10^{-4} to 1×10^{-6} established by USEPA as being representative of an acceptable risk. Sediment cleanup levels were established to protect ecological receptors and establish sediment levels at or near background.

The industrial park worker was assumed to be entering the site for purposes of maintaining the remedy. Maintenance activities would include quarterly to monthly visits to the area for brief inspections of the cap and wetlands, mowing of the cap, and brief labor to address minor maintenance issues (e.g. removal of obstructions from the drainage ditches).

6.2.4 Toxicity and Other Contaminant Characteristics

USEPA Region III revises its list of RSLs semi-annually. Only chromium and benzo(a) pyrene ROD levels were below the RSLs for the soil in the lagoon and scraped areas and the sediment. Therefore, the Increased Lifetime Cancer Risk (ILCR) and the Hazard Index was recalculated for the 1999 ROD cleanup levels, in accordance with USEPA's Risk Assessment Guidance for Superfund (RAGS). The current reference doses and slope factors were retrieved from the IRIS Database for Risk Assessment.

Cleanup levels were substituted for maximum detected concentrations in the risk-ratio screening process. The receptor evaluated was an industrial worker, as in the 1999 ROD. As performed for that ROD, soil and sediments were evaluated. Also as in the 1999 ROD, the compounds evaluated for the FYR follow:

- Total cPAHs (soil only)
- Benzo(a) pyrene (soil only)
- Arsenic
- Cadmium

- Chromium (sediment only)
- Copper
- Lead
- Mercury (sediment only)
- Zinc (sediment only)

For the FYR, each compound's effect for each medium on an industrial worker was evaluated. Protectiveness is assumed when ILCRs are less than $5x10^{-5}$ and HIs are not greater than 1. Based on these risk assessments, there were no unacceptable cancer risks. The combined ILCRs were $4.1x\ 10^{-5}$ and $1.2x\ 10^{-7}$ for the soil and sediment, respectively, which are both well within USEPA's acceptable risk management range. HIs for soil and sediment are 0.9 and 0.04, respectively, and no individual HI is greater than 0.5. Since HIs for all contaminants are less than 1.0, there are also no unacceptable non-cancer risks.

6.3 Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

There is no information that questions the protectiveness of the remedy. The landfill cover must be properly maintained to ensure long-term protectiveness of the remedy. Regular maintenance such as mowing the cap when needed, removal of silt from drainage areas and revegetating barren areas must continue to be performed.

7.0 ISSUES

No issues affecting protectiveness of the remedy were identified during this Five Year Review.

8.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

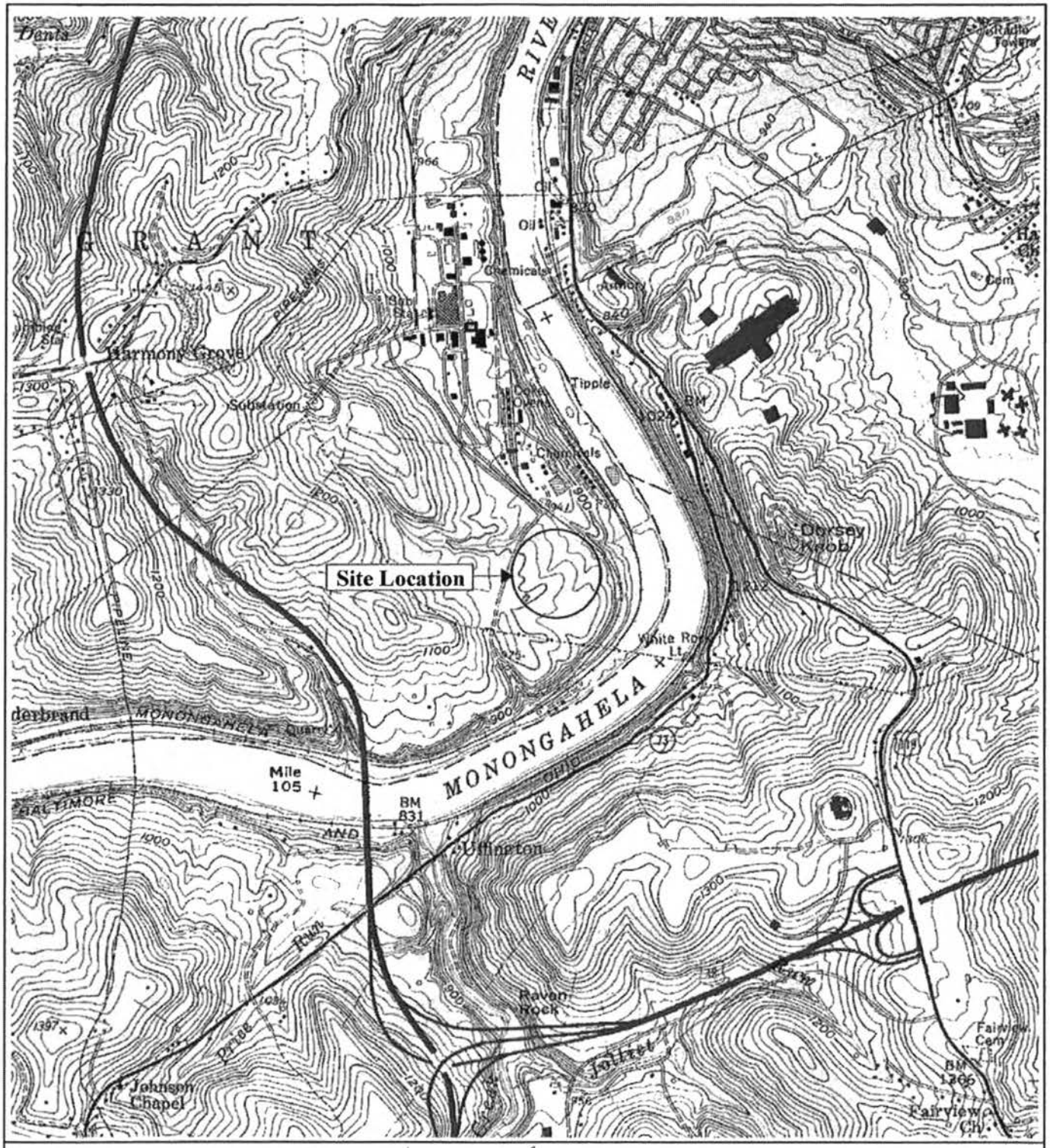
There are no recommendations or follow-up actions associated with this Five Year Review.

9.0 PROTECTIVENESS STATEMENT

The PRPs have implemented the remedy at Operable Unit One in accordance with the remedial action objectives of the 1999 ROD, and it is currently functioning as intended. This Five Year Review found that the remedy is protective of human health and the environment.

10.0 NEXT REVIEW

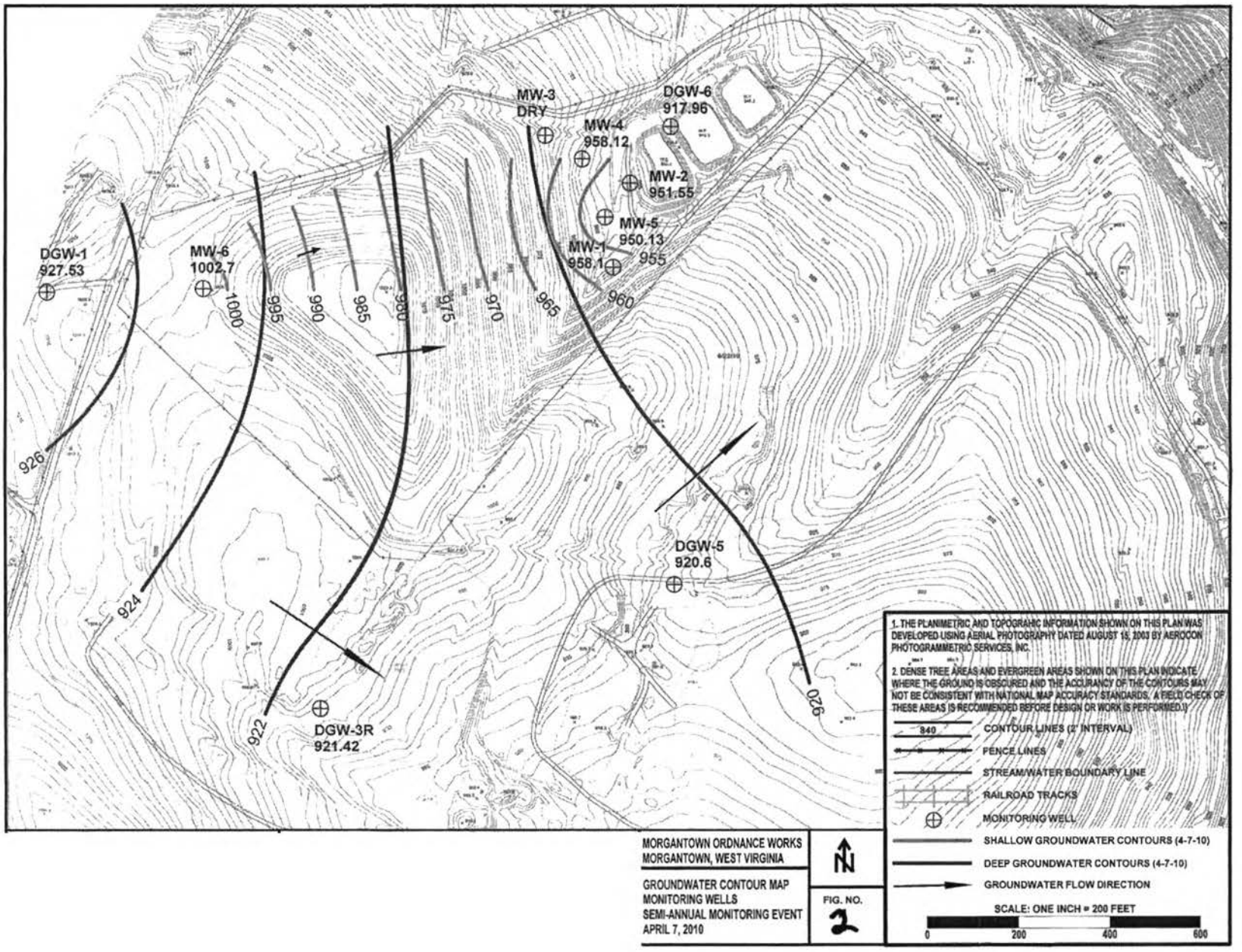
The next FYR of remedial actions implemented on the OWDA should occur within five years of the completion date on the cover of the final version of this report. FYRs will continue as long as waste remains in place above levels that allow for unlimited use and unrestricted exposure.



REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE,
MORGANTOWN SOUTH
MORGANTOWN, WEST VIRGINIA
REVISED 1976. SCALE 1:24000

Figure 1
Site Location
Morgantown Ordnance Works
Morgantown, West Virginia

457302-01


MW-3
DRY
DGW-6
917.96
MW-4
958.12
MW-2
951.55
MW-5
950.13
MW-1
958.1
DGW-1
927.53
MW-6
1002.7
DGW-5
920.6
DGW-3R
921.42
1000
995
990
985
980
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955
926
924
922
920
1. THE PLANIMETRIC AND TOPOGRAHIC INFORMATION SHOWN ON THIS PLAN WAS DEVELOPED USING AERIAL PHOTOGRAPHY DATED AUGUST 15, 2003 BY AEROCON PHOTOGRAMMETRIC SERVICES, INC.
2. DENSE TREE AREAS AND EVERGREEN AREAS SHOWN ON THIS PLAN INDICATE WHERE THE GROUND IS OBSCURED AND THE ACCURANCY OF THE CONTOURS MAY NOT BE CONSISTENT WITH NATIONAL MAP ACCURACY STANDARDS. A FIELD CHECK OF THESE AREAS IS RECOMMENDED BEFORE DESIGN OR WORK IS PERFORMED.)
940 CONTOUR LINES (2' INTERVAL)
FENCE LINES
STREAM/WATER BOUNDARY LINE
RAILROAD TRACKS
MONITORING WELL
SHALLOW GROUNDWATER CONTOURS (4-7-10)
DEEP GROUNDWATER CONTOURS (4-7-10)
GROUNDWATER FLOW DIRECTION
SCALE: ONE INCH = 200 FEET
0
200
400
600
MORGANTOWN ORDNANCE WORKS
MORGANTOWN, WEST VIRGINIA
GROUNDWATER CONTOUR MAP
MONITORING WELLS
SEMI-ANNUAL MONITORING EVENT
APRIL 7, 2010
N
FIG. NO.
2

Table 3 Shallow Monitoring Well SVOC Detections

Analyte	MW1								MW2								Regulatory Values	
	11/8/2006	3/27/2007	9/26/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	11/8/2006	3/27/2007	9/26/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
anthracene	ND	ND	ND	ND	ND	ND	0.91	ND	ND	ND	ND	ND	ND	ND	ND	ND	1100	
Benzo (a) anthracene	ND	ND	ND	ND	ND	ND	0.61	ND	ND	ND	ND	0.83	ND	ND	ND	ND	0.029	
Benzo (a) pyrene	ND	ND	ND	ND	ND	ND	0.76	ND	ND	ND	ND	2.2	ND	ND	ND	ND	0.0029	0.2
Benzo (b) fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.2	ND	ND	ND	ND	0.029	
Benzo (k) fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5.9	ND	ND	ND	ND	0.29	
Benzo (ghi) perylene	ND	ND	ND	ND	ND	ND	0.69	ND	ND	ND	ND	0.86	ND	ND	ND	ND		
Butyl benzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35	
Carbazole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
4-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.9	ND	ND	ND	ND	0.34	
Chrysene	ND	ND	ND	ND	ND	ND	1	ND	ND	ND	ND	0.77	ND	ND	ND	ND	2.9	
Dibenz (a,h) anthracene	ND	ND	ND	ND	ND	ND	0.82	ND	ND	ND	ND	2.5	ND	ND	ND	ND	0.0029	
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	0.3	ND	ND	ND	ND	0.45	ND	ND	ND	ND	3400	
Fluoranthene	ND	ND	ND	ND	ND	ND	0.35	ND	ND	ND	ND	2.9	ND	ND	ND	ND	1500	
Indeno (1,2,3-cd) pyrene	ND	ND	ND	ND	ND	ND	0.73	ND	ND	ND	ND	2.3	ND	ND	ND	ND	0.029	
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Pyrene	ND	ND	ND	ND	ND	ND	0.45	ND	ND	ND	ND	ND	ND	ND	ND	ND	1100	

Notes:
Units are in ug/L
ND= 0 or No sample
Well MW3 not sampled for events listed

Table 3 Shallow Monitoring Well SVOC Detections (continued)

Analyte	MW4								MW5								Regulatory Values	
	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1100	
Benzo (a) anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.029	
Benzo (a) pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0029	0.2
Benzo (b) fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.029	
Benzo (k) fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.29	
Benzo (ghi) perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Butyl benzyl phthalate	ND	ND	ND	2.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	35	
Carbazole	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
4-Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.34	
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	2.9	
Dibenz (a,h) anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0029	
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	3400	
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1500	
Indeno (1,2,3-cd) pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.029	
3-Nitroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Phenanthrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND		
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1100	

Notes:
Units are in ug/L
ND = 0 or No sample
Well MW3 not sampled for events listed

Table 3 Shallow Monitoring Well SVOC Detections (continued)

Analyte	MW6 background									Regulatory Values	
	11/8/2006	3/27/2007	9/17/2007	3/24/2008	3/24/2008Dup	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
anthracene	ND	ND	2.7	ND	0.59	ND	ND	ND	ND	1100	
Benzo (a) anthracene	ND	ND	ND	ND	1.2	ND	ND	ND	ND	0.029	
Benzo (a) pyrene	ND	ND	ND	ND	2.4	ND	ND	ND	ND	0.0029	0.2
Benzo (b) fluoranthene	ND	ND	ND	ND	5.4	ND	ND	ND	ND	0.029	
Benzo (k) fluoranthene	ND	ND	ND	ND	6.3	ND	ND	ND	ND	0.29	
Benzo (ghi) perylene	ND	ND	ND	ND	1.2	ND	ND	ND	ND		
Butyl benzyl phthalate	ND	ND	ND	ND	1.4	ND	ND	ND	ND	35	
Carbazole	ND	ND	ND	ND	0.68	ND	ND	ND	ND		
4-Chloroaniline	ND	ND	ND	ND	5.3	ND	ND	ND	ND	0.34	
Chrysene	ND	ND	ND	ND	1.4	ND	ND	ND	ND	2.9	
Dibenz (a,h) anthracene	ND	ND	ND	ND	2.7	ND	ND	ND	ND	0.0029	
Di-n-butyl phthalate	ND	ND	ND	ND	0.87	ND	ND	ND	ND	3400	
Fluoranthene	ND	ND	ND	ND	3.4	ND	ND	ND	ND	1500	
Indeno (1,2,3-cd) pyrene	ND	ND	ND	ND	2.8	ND	ND	ND	ND	0.029	
3-Nitroaniline	ND	ND	ND	ND	0.82	ND	ND	ND	ND		
Phenanthrene	ND	ND	ND	ND	0.59	ND	ND	ND	ND		
Pyrene	ND	ND	ND	ND	1	ND	ND	ND	ND	1100	

Notes:
Units are in ug/L
ND = 0 or No sample
Well MW3 not sampled for events listed

Table 4 Bedrock Monitoring Well SVOC Detections																		
Analyte	DGW1								DGW3R								Regulatory Values	
	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
Benzo (a) anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	0	3.1	ND	0.029	NE
Benzo (a) pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.83	0	0	ND	0.0029	0.2
Benzo (b) fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.5	0	2.7	ND	0.029	NE
Benzo (k) fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.8	0	2.3	ND	0.29	NE
benzo (ghi) perylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.66	3.1	0	ND	NE	NE
Chrysene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.7	0	0	ND	2.9	NE
Dibenz (a,h) anthracene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.1	0	0	ND	0.0029	NE
Diethylphthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	1	0	ND	29000	NE
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	1.6	0	ND	0.12	NE
butyl benzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0	0	ND	35	NE
Di-n-octyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0	4.4	ND	NE	NE
Fluoranthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0	0.98	ND	1500	NE
Pyrene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0	0	ND	1100	NE
Di-n-butylphthalate	ND	ND	ND	ND	ND	ND	ND	5	ND	ND	ND	ND	0	0	0	6	3700	NE
Chloroaniline	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0	0	0	ND	0.34	NE

Notes:
Units are in ug/L
0 = ND or No sample
NE = Not Established

Table 4 Bedrock Monitoring Well SVOC Detections (continued)

Analyte	DGW5								DGW6								Regulatory Values	
	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
Benzo (a) anthracene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0.8	ND	0.029	NE
Benzo (a) pyrene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0.42	ND	0.0029	0.2
Benzo (b) fluoranthene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0.62	ND	0.029	NE
Benzo (k) fluoranthene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0.5	ND	0.29	NE
benzo (ghi) perylene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0	ND	NE	NE
Chrysene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0.79	ND	2.9	NE
Dibenz (a,h) anthracene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0	ND	0.0029	NE
Diethylphthalate	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0	ND	29000	NE
Nitrobenzene	ND	ND	ND	ND	0	4.8	0	ND	ND	ND	ND	ND	ND	0	0	ND	0.12	NE
butyl benzyl phthalate	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	24	0	ND	35	NE
Di-n-octyl phthalate	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0	ND	NE	NE
Fluoranthene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0.25	ND	1500	NE
Pyrene	ND	ND	ND	ND	0	0	0	ND	ND	ND	ND	ND	ND	0	0.32	ND	1100	NE
Di-n-butylphthalate	ND	ND	ND	ND	0	0	0	4	ND	ND	ND	ND	ND	0	0	0	3700	NE
Chloroaniline	ND	ND	ND	0.51	0	0	0	ND	ND	ND	ND	ND	ND	0	0	ND	0.34	NE

Notes:
Units are in ug/L
0 = ND or No sample

Table 5 Shallow Monitoring Well Inorganic Detections

Analyte	MW1								MW2								Regulatory Values	
	11/8/2006	3/27/2007	9/26/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	11/8/2006	3/27/2007	9/26/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
Arsenic	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.0 B	ND	ND	ND	ND	ND	ND	0.045	10
Iron	ND	ND	1770	ND	367	38.4 B	194	ND	945	5560	3280	778	1380	283	683	126 J	26000	NE
Manganese	32.8	169	1040	211	324	29.8	190	896	35300	30300	41100	19700	27200	5040	17100	6920	880	NE
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	23.8 B	6.4 B,J	ND	ND	ND	ND	ND	ND	0.37	2

Note:
ND = Non Detect
B indicates estimted value
J indicates analyte detected in method blank
All Units are ug/L
NE = Not Established

Table 5 Shallow Monitoring Well Inorganic Detections (continued)

Analyte	MW4								MW5								Regulatory Values	
	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	11/8/2006	3/27/2007	9/17/2007	3/24/2008	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
Arsenic	ND	ND	16.7	9.5 B	6.9 B	2.2 B	4.6 B	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.045	10
Iron	1470	1680	13000	7800	7170	684	6330	657	195	253	667	ND	193	ND	3170	ND	26000	NE
Manganese	3220	6650	6610	6130	5640	4250	3930	1740	556	750	2180	617	2240	1030	1560	46.1	880	NE
Thallium	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.37	2

Note:
ND = Non Detect
B indicates estimted value
J indicates analyte detected in method blank
NE = Not Established

Table 5 Shallow Monitoring Well Inorganic Detections (continued)

Analyte	MW6 background									Regulatory Values	
	11/8/2006	3/27/2007	9/17/2007	3/24/2008	3/24/2008Dup	9/17/2008	4/8/2009	11/3/2009	4/7/2010	RSL	MCL
Arsenic	ND	2.8 B	4.4 B	ND	2.2 B	6.2 B	ND	4.6 B	ND	0.045	10
Iron	6790	13400	12800	ND	13200	13700	7190	5120	4310	26000	NE
Manganese	7680	6610	5980	ND	6720	4990	6930	3120	5130	880	NE
Thallium	ND	4.4 B,J	ND	ND	5.4	ND	ND		ND	0.37	2

Note:
ND = Non Detect
B indicates estimted value
J indicates analyte detected in method blank
All Units are ug/L
NE = Not Established

Table 6 - Cleanup Standard for Soils	
Contaminant	Cleanup Level (mg/kg)
Total cPAHs	78 (18.2 B(a)P equivalent
Arsenic	88.8
Cadmium	642
Copper	41,100
Lead	500

Reference:
1999 Record of Decision
Ordnance Works Disposal Areas Site

Table 7 Sediment Cleanup Levels	
Contaminant	(ppm)
Arsenic	9.62
Cadmium	0.35
Chromium	30.2
Copper	22.7
Lead	31.6
Mercury	ND
Zinc	86.8

Reference:
1999 Record of Decision
Ordnance Works Disposal Areas Site